Indicative Syllabus for the post of Executive Engineer
Advertisement No. Estt./NFR/2025/1131 dated 12/06/2025

Section-I

Aptitude- Averages, Number System, Profit and Loss, Time and Work, Problems on Trains, Compound Interest, Decimal Fractions, Calendar, Area, Problems on Numbers, Square Root and Cube Root, Boats and Streams, Probability, Interest, Percentage, Ratio, Time And Distance, Problems on Ages, Partnership, Clock, Simplifications, Volume and Surface, Problems on H.C.F And L.C.M, Logarithm, Chain Rule, Pipes and Cistern, Odd Man Out and Series, Height and Distance etc.

Reasoning- Number Series Compilation, Missing Number Finding, Continuous Pattern Series, Direction Sense Test, Puzzle, Verbal Classification, Matching Definitions, Logical Deduction, Series Compilations, Classification, Missing Character Finding, Odd Man Out, Blood Relations, Analogy, Coding And Decoding, Truth Verification of The Statement, Syllogisms, Analogies, Verbal Reasoning, Statement and Conclusions, Letter and Symbol Series, Logical Problems, Logical Sequence of Words, Arithmetic Reasoning, Data Sufficiency etc.

General English- Antonyms, Synonyms, Spelling Check, Change of Voice, Spotting Errors, Sentence Improvement, One Word Substitute, Selecting Words, Sentence Corrections, Idioms and Phrases, Communication Skills, Common Error Detection, Sentence Compilation, Ordering of Words, Ordering of Sentences, Verbal Analogies, Sentence Formation, Completing Statements, Change of Speech etc.

GK- Indian History, Indian Economy, Indian Culture, Environmental Science, Awards and Honors, Famous Places in India, World Organization, Sports, Books and Authors, Famous Personalities, Days and Years, World Geography, Basic General Knowledge, Physics, Biology, Indian Politics, Indian Geography, General Science, Chemistry, Technology, Inventions, Current Affairs etc.

Computer Fundamentals- Computer Fundamentals: Includes questions on Operating System, MS Office, MS Word, MS Excel, Power Point, Internet, E-mail, Antivirus and various online tools used in day to-day office work etc.

Section-II

Domain Knowledge:

An Executive Engineer is expected to be well-versed in CPWD Manuals, the General Financial Rules, and the Procurement Manuals for Works issued by the Ministry of Finance, Government of India. Apart from the above, the indicative syllabus of core specializations under Domain Knowledge is as under:

SPECIALIZATION: ELECTRICAL ENGINEERING

Engineering Mathematics: Matrix theory, Eigen values & Eigen vectors system of linear equations, Numerical methods for solution of nonlinear algebraic equation and differential equations, integral calculus, partial derivatives, maxima and minima, line Surface and Volume Integrals. Flourier series, linear, nonlinear and partial differential equations, initial and boundary value problems, complex variables, Taylor's and Laurent's series, residue theorem, probability and statistics fundamentals, Sampling theorem, random variables, Normal and Poisson distributions, correlation and regression analysis.

Electrical Materials: Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials – basics, properties and applications, ferrities, terro-magnetic materials and components; basic of solid state physics conductors, photo conductivity, Basic of Nano materials and Super conductors.

Electric Circuits and Fields: Circuit elements, network graph, KCL, KVL, Node and Mesh analysis, ideal current and voltage sources, Thevenin's, Norton's, Superposition and Maximum Power Transfer theorems, transient response of DC and AC networks, Sinusoidal steady state analysis, basic filter concepts, two post networks, three phase circuits, Magnetically coupled circuits, Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distribution, Ampere's and Biot-Savart's laws; inductance, dielectrics, capacitance, Maxwell's equations.

Electrical and Electronic Measurement: Principles of measurement, accuracy precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basic of sensors, Transducers, basic of acquisition systems.

Computer Fundamentals: Number systems, Boolean algebra, arithmetic functions, Basic Architecture, Central Processing Unit, I/O and Memory Organisation peripheral devices, data representation and programming basics of Operating system and networking, virtual memory, file systems. Elements of programming languages, typical examples.

Basic Electronics Engineering: Basics of Semiconductor diodes and transistors and characteristics, junction and field effect transistors (BJT, FET and MOSFETS), different types of transistor amplifiers, equivalent circuits and frequency response, oscillators and other circuits, feedback amplifiers.

Analog and Digital Electronics: Operational amplifiers – characteristics and applications combinational and sequential logic circuits, multiplexers, multi vibrators, samples and hold circuits, A/D and D/A converters, basic of filter circuits and applications, simple active filters; Microprocessor basics – interfaces and applications, basics of linear integrated circuits ; Analog communication basics; Modulation and demodulation, noise and bandwidth, transmitters and receivers, signal to noise ratio, digital communication basics, sampling, quantizing, coding, frequency and time domain multiplexing, power line carrier communication systems.

Systems and Signal Processing: Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and casual systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transforms, Z transforms, Discrete Fourier transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter bilinear transformation.

Control Systems: Principles of feedback, transfer function, block diagrams and signal flow graphs, steady state errors, transforms and their applications, Routh hurwitch criterion, Nyquist techniques, Bode plots, root loci, lag, lead and lead lag compensation, stability analysis, transient and frequency response analysis, state space model, state transition matrix controllability and observability, linear state variable feedback, PID and industrial controllers.,

Electrical Machines: Single phase transformers, three phase transformers – connections, parallel operation, auto transformer, energy conversion principles, DC machines – types, winding, generator characteristics, armature reaction and commutation, starting and speed control of motors, induction motors – principles, types, performance characteristics starting and speed control, Synchronous machines – performance regulation, parallel operation and generators, motor starting characteristics and applications, servo and stepper motors.

Power Systems : Basic power generation concepts, steam, gas and water turbines, transmission line models and performance, cable performance, insulation, corona and radio interference, power factor correction, symmetrical components, fault analysis, principles of protection systems, basics of solid state relays and digital protection, circuits breakers, Radial and ring main distribution systems, Matrix representation of power systems, load flow analysis, voltage control and economic operation, system stability concepts, Swing curves and equal area criterion. HVDC transmission and FACTS concepts of power system dynamics, distributed generation, solar and wind power, smart grid concepts, environmental implications, fundamentals of power economics.

Power Electronics and Drives : Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operations triggering circuits, phase control rectifiers, bridge converters - fully controlled and half controlled, principles of choppers and inverters, basis concepts of adjustable speed DC and 3 AC drives, DC-DC switched mode converters, DC-AC switched mode converters, resonant converters, high frequency inductors and transformers, power supplies etc.

SPECIALIZATION: CIVIL ENGINEERING

Building Material: Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminium, Fly Ash, Basic Admixture, Timber, Bricks and Aggregates; Classification, properties, and selection criteria; Cement: Types, Composition, Properties, Uses, Specifications, and various Tests; Lime & Cement Mortars and Concrete; Properties and various Tests; Design of Concrete Mixes; Proportioning of aggregates and methods of mix design.

Solid Mechanics: Elastic constants; Stress, plane stress, strains, plane strain, Mohr's circle of stress and strain, Elastic theories of failure, Principal stresses, Bending, shear and Torsion.

Structural Analysis: Basics of strength of materials, Types of stresses and strains, bending moments and shear force, concept of bending and shear stresses; Analysis of determinate and indeterminate structures; Trusses, beams, plane frames; Rolling loads, influence Lines, Unit load method & other methods; Free and Forced vibration of single degree and multi degree freedom system, Suspended Cables; Concepts and use of Computer Aided Design.

Design of Steel Structures: Principles of Working stress methods, Design of tension and compression members, Design and beams and beam column connections, built-up sections, Girders, industrial roofs, Principles of Ultimate load design.

Design of Concrete and Masonry Structure: Limit state design for bending, shear, axial compression, and combined forces; Design of beams, slabs, Lintels, Foundations, Retaining walls, Tanks, Staircase; Principles of pre-stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

Construction Practice, Planning and Management: Construction – Planning, Equipment, Site investigation and Management including Estimation with latest project management tools and network analysis for different Types of works, Analysis of rates of various types of work Tendering Process and Contract Management, Quality Control, Productivity, Operation Cost; Land acquisition, Labour safety and welfare.

Flow of Fluids, Hydraulic Machines and Hydro Power:

Fluid Mechanics, Open Channel Flow, Pipe Flow: Fluid properties, Dimensional Analysis and Modeling; Fluid dynamics including flow kinematics and measurements; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Principles in open channel flow, Flow controls. Hydraulic jump; Surges; Pipe network;

Hydraulic Machines and Hydro Power: Various pumps, Air vessels, Hydraulic turbines – types, classifications & performance parameters; Power house – classification and layout, storage pondage, control of supply.

Hydrology and water resources Engineering: Hydrological cycle, Ground water hydrology, Well hydrology and related data analysis; Streams and their gauging; River morphology; Flood, drought, and their management; Capacity of Reservoirs.

Water Resources Engineering: Multipurpose uses of Water, River basins and their potential, irrigation systems, water demand assessment, Resources – storage and their yields; Water logging, canal and drainage design, Gravity dams, falls, weirs, Energy dissipaters barrage Distribution works, Cross drainage works and head works and their design; Concepts in canal design, construction & maintenance; River training measurement and analysis of rainfall.

Environmental Engineering:

Water Supply Engineering: Sources, Estimation, quality standards and testing of water and their treatment, Rural Institutional and industrial water supply, Physical, chemical and biological characteristics and sources of water, pollutants in water and its effects, Estimation of water demand, Drinking water standards, Water Treatment Plants, Water distribution network.

Waste Water Engineering: Planning & design of domestic waste water, sewage collection and disposal; plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste water disposal system; sludge management including treatment, disposal and re-use of treated effluents; industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

Solid Waste Management: Sources & Classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes and Utilization by Civil Engineers.

Air, Noise, Pollution and Ecology: Concepts & general methodology.

Geo-technical Engineering and Foundation Engineering:

Geo-technical Engineering: Soil exploration – planning & methods, Properties of soil, classification, various tests and inter relationships; Permeability & Seepage, Compressibility, consolidation and shearing resistance, Earth pressure theories and stress distribution in soil; properties and uses of geosynthetics.

Foundation Engineering: Types of foundations & selection criteria, bearing capacity, settlement analysis, design and testing of shallow & deep foundations, Slope stability analysis, Earthen embankments, Dams and Earth retaining structures; types, analysis and design, Principles of ground modifications.

Surveying and Geology: (a) Surveying: Classification of surveys, various methodologies, instruments & analysis of measurement of distances, elevation and directions, Field astronomy, global Positioning System; Map preparation; Photogrammetry; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road / railway alignment, and building, setting out of curves. (b) Geology: Basic knowledge of Engineering geology & its application in projects.

Transportation Engineering: Highway: Planning & construction methodology, Alignment, and geometric design; Traffic Surveys and Controls, Principles of Flexible and Rigid pavements design. Tunneling: Alignment, methods of construction, disposal of muck, drainage, lighting, and ventilation. Railway Systems: Terminology, Planning, design, and maintenance practices; track modernization Harbours: Terminology, layouts, and planning Airports: Layout, Planning, and design etc.